

Indoor Air Quality and the Function of Fresh Air Supplies and Exhaust Vents in Schools, Part III

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This series of articles explain how a building's indoor air quality can be affected by ventilation systems. This third and final installment explains how malfunctioning exhaust ventilation systems can adversely effect indoor air quality.

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As noted in previous articles in this series, ventilation systems consist of two distinct sections, fresh air supply and exhaust vents. Problems with exhaust vents can play a roll in either creating or exacerbating conditions that can result in increased complaints of odor, discomfort or other related conditions that are associated with poor indoor air quality. Where the purpose of supply vents is to provide fresh tempered air into an interior space, exhaust ventilation is designed to remove stale air. As air is removed, indoor air pollutants that are within any building are directed outdoors. In school buildings, exhaust ventilation systems can be divided into two categories: general ventilation that works in concert with the fresh air supplies or exhaust vents that are dedicated to a specific activity or purpose. The following conditions should be considered as they can have a negative impact on indoor air quality.

General Exhaust Ventilation

-Examine exhaust vents for blockage by classroom materials. In almost every investigation by BEHA staff, exhaust vents blocked by filing cabinets, boxes, book shelves, wall posters, furniture and other common classroom items have been found in

classrooms across Massachusetts and contributed to air measurements that exceed air quality/comfort guidelines established by the MDPH. Blockages of these vents prevent this equipment from exhausting air from classrooms. In numerous cases, items have been placed which block exhaust vents because building occupants do not know what purpose these vents serve. As a rule, exhaust vents need an unobstructed path to the interior of the room in order to maximize efficiency.

-Airflow into exhaust vents in older schools (pre-late 1960's in general) may be controlled using a louver system located in a hearth-like structure on the interior wall of the classroom. Airflow into these vents is controlled by the angle of the louver within, which is set in place by a chain and pulley system. If the chain that fixes the louver is seen hanging at the rear of the hearth, this usually indicates that the exhaust vent louver is closed, resulting in no exhaust ventilation.

-In newer buildings, moveable vanes on the exhaust vent grill are used to control airflow into this vent. If these vanes are frozen closed, airflow is restricted.

-If exhaust vents are purposely blocked with paper or are found to be backdrafting cold air, this can indicate that the motors controlling the airflow for the exhaust vent are either broken, missing fan belts or are wired inappropriately.

-The activation/deactivation of general exhaust vents in classrooms are frequently controlled by thermostats in equipment. Once a thermostat detects a preset temperature,

the exhaust ventilation system is activated. Exhaust ventilation should operate at all times that the fresh air supply is in operation. The fresh air supply system should be in operation when an area is occupied.

-Some older buildings use a non-mechanical exhaust ventilation system that relies on rising heated air to create exhaust ventilation. These systems are called natural ventilation systems. Airflow into these vents is usually controlled by a louvered, chain and pulley system previously noted. Frequently, these systems terminate in roof structures that resemble chimneys. These particular systems are highly vulnerable to bird roosting. Bird droppings can be a source of several diseases. If bird roosting is suspected or wastes are found in the floor of vents, removal of wastes and disinfection with an appropriate antimicrobial by trained professionals should be done.

Typical IAQ Problems Related to Exhaust Ventilation

Several areas in schools or other buildings will have areas with specially designed exhaust ventilation systems that are designed to remove noxious odors or chemicals from within occupied spaces. Exhaust ventilation should be designed in these areas to place the room or a specific piece of equipment under negative pressure. If the area or equipment is placed under negative pressure by the exhaust ventilation system, materials or odors being generated in these areas should have no impact on adjacent space. The following conditions are commonly encountered observations indicating malfunction, poor performance or operation of these forms of exhaust ventilation.

-Lingering odors or moisture in restrooms can indicate inadequate or deactivated exhaust ventilation. Restrooms typically have exhaust vents without fresh air supplies to prevent odors and water vapor from penetrating into adjacent hallways or rooms. If odors, mold growth or unusual amounts of condensation are noted in rest rooms, these all can be signs of a malfunctioning or inadequate mechanical exhaust vent system. The lingering odor of deodorizers in restrooms may also indicate poor exhaust ventilation. Deodorizers do not remove odors but rather are used to mask unpleasant odors. If the exhaust system is adequately functioning, heavy deodorizer use or lingering odors would be rapidly eliminated from the restroom. Frequently, the restroom light switch activates exhaust vents. Restroom exhaust ventilation should operate during the hours of occupancy of a building.

-If cooking odors are noted beyond the kitchen and cafeteria, this can indicate malfunctioning stove exhaust vents.

-Wood dust odors in hallways adjacent to carpentry shops can indicate poorly operating or non-existent exhaust ventilation or wood dust collection equipment in shops. Please note it is recommended that a wood dust collection system have an exhaust vent to the outdoors. In a number of MDPH evaluations, wood dust collectors located indoors have been found lacking these vents. While filters in this equipment remove visible particles of wood dust, respirable wood dust particulates can be aerosolized into the interior of the wood shop. Respirable wood dust particles can be irritating to the eyes, nose and throat.

-In buildings with vocational education programs, the detection of vehicle exhaust in the building can indicate poor exhaust ventilation systems in automobile shops. Exhaust ventilation in these areas is particularly important due to the production of carbon monoxide from gasoline powered engines.

-Art rooms with heavy deposition of fine clay dust on flat surfaces can indicate inadequate ventilation for the pottery kiln. Local exhaust ventilation is important for such equipment because carbon monoxide, sulfur dioxide and lead fume may be emitted from the pottery kiln during use. These materials must be exhausted from the building to prevent exposure.

-Odors detected in hallways or classrooms immediately adjacent to science classrooms, science program equipment/chemical storage areas, custodial closets, autobody shops, cosmetology shops, metal shops, art rooms, photography dark rooms, print shops, swimming pools, stage areas or areas of a building that are under renovation can indicate poor exhaust ventilation in areas that may use chemicals or products containing odorous materials. In each of these cases, poor exhaust ventilation has been noted to play a role in failing to remove noxious materials resulting in building occupant exposure.

Another concern can be the location of where exhausted air exits a building. In a number of cases, exhaust vents have been found in close proximity to mechanical fresh air intakes. The location of exhaust vents in these areas can result in materials exhausted by the mechanical ventilation system being reintroduced into the building through the fresh

air supply system. The best practice is to locate special purpose exhaust vents at the greatest practicable distance from fresh air intakes. If not possible, the BOCA Code requires that vents emitting hazardous materials be at a minimum 10 feet distance on the horizontal plane or 2 feet above fresh air intakes (BOCA, 1993).

In each of these instances, a properly designed and operating exhaust ventilation system will remove environmental pollutants from the interior of a building and help reduce symptoms that are attributed to poor indoor air quality. As part of any indoor air quality investigation, an examination of exhaust ventilation may provide one piece of the puzzle that contributes to complaints of poor indoor air quality in a building.

Cory Holmes, Suzan Donahue and Suzanne Condon of the MDPH Bureau of Environmental Health Assessment all contributed to this article.

Reference

BOCA. , 1993. The BOCA National Mechanical Code/1993. 8th ed. Building Officials and Code Administrators International, Inc., Country Club Hill, IL. Section M-308.1.1.